

IN THE CLAIMS:

1-6. (Canceled)

7. (Previously Presented) A medical instrument holding apparatus comprising:

a medical instrument;

a supporting mechanism which has a distal end portion supporting the medical instrument and a holding portion being held by the operator;

a moving mechanism which has first and second sides and which supports the supporting mechanism;

a shaft portion located between the first and second sides and allowing the medical instrument and the supporting mechanism to be rotated about the shaft portion;

a basal portion which is coupled to the shaft portion, the basal portion supporting the moving mechanism and allowing the moving mechanism to rotate about the shaft portion;

a ball joint located between the moving mechanism and the supporting mechanism to operatively connect the moving mechanism and the supporting mechanism, the ball joint being provided in a position shifted from a center of gravity of the holding portion on the supporting mechanism toward the moving mechanism, the ball joint further supporting the supporting mechanism to be pivotable with respect to the moving mechanism; and

a counterweight which is located on the second side of the moving mechanism such that a first rotation moment is smaller than a second rotation moment generated from the weights of the medical instrument and the supporting mechanism, the counterweight acting about the shaft portion in the opposite direction to the second rotation moment;

wherein:

the moving mechanism and the supporting mechanism have braking mechanisms capable of being switched between a restrictive state in which the moving and supporting mechanisms are prevented from moving and a permissive state in which the mechanisms are allowed to move, and the supporting mechanism has a switch which is operated by an operator and switches the braking mechanisms to switch the moving and supporting mechanisms between the restrictive state and the permissive state;

the holding portion is located so that a combined center of gravity of the holding portion and the medical instrument and the center of operation by the operator are situated in different positions on the holding portion; a center of inclination of the ball joint around which the holding portion is inclined by means of the ball joint being situated in a position different from the combined center of gravity of the holding portion and the medical instrument and the supporting mechanism further includes a support arm having a first end and a second end, the first end being supported on the moving mechanism;

the moving mechanism has a parallelogrammatic link mechanism, the link mechanism including: a first arm having first and second arm ends, the first arm end being connected to the support arm; a second arm having third and fourth arm ends, the third arm end being rotatably connected to the first arm end of the first arm, the second arm being coupled to the shaft portion between the third and fourth arm ends of the second arm to support the moving mechanism for rotating motion; a third arm kept parallel to the second arm and having fifth and sixth arm ends, the sixth arm end being connected to the second arm end of the first arm; and a fourth arm having seventh and eighth arm ends, the seventh arm end being connected to the fourth arm end of the second arm and the eighth arm end being

connected to the fifth arm end of the third arm so as to be parallel to the first arm, the counterweight being located on the eighth arm end of the fourth arm;

the first arm is shorter than the fourth and second arms;

the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis of the fourth arm; and

the ball joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving mechanism, and the adjusting mechanism includes an arithmetic mechanism which calculates the variation of the rotation moment around the shaft portion, based on the angle of inclination of the holding portion detected by means of the detecting mechanism, and a barycenter position adjusting mechanism which moves the counterweight along the axis of the fourth arm, thereby adjusting the position of the center of gravity of the counterweight, in accordance with the result of computation by the arithmetic mechanism.

8. (Canceled)

9. (Previously Presented) A medical instrument holding apparatus comprising:
a medical instrument;

a supporting mechanism which has a distal end portion supporting the medical instrument and a holding portion being held by the operator;

a moving mechanism which has first and second sides and which supports the supporting mechanism;

a shaft portion located between the first and second sides and allowing the medical instrument and the supporting mechanism to be rotated about the shaft portion;

a basal portion which is coupled to the shaft portion, the basal portion supporting the moving mechanism and allowing the moving mechanism to rotate about the shaft portion;

a ball joint located between the moving mechanism and the supporting mechanism to operatively connect the moving mechanism and the supporting mechanism, the ball joint being provided in a position shifted from a center of gravity of the holding portion on the supporting mechanism toward the moving mechanism, the ball joint further supporting the supporting mechanism to be pivotable with respect to the moving mechanism; and

a counterweight which is located on the second side of the moving mechanism such that a first rotation moment is smaller than a second rotation moment generated from the weights of the medical instrument and the supporting mechanism, the counterweight acting about the shaft portion in the opposite direction to the second rotation moment;

wherein:

the moving mechanism and the supporting mechanism have braking mechanisms capable of being switched between a restrictive state in which the moving and supporting mechanisms are prevented from moving and a permissive state in which the mechanisms are allowed to move, and the supporting mechanism has a switch which is operated by an operator and switches the braking mechanisms to switch the moving and supporting mechanisms between the restrictive state and the permissive state;

the holding portion is located so that a combined center of gravity of the holding portion and the medical instrument and the center of operation by the operator are situated in different positions on the holding portion; a center of inclination of the ball joint around which the holding portion is inclined by means of the ball joint being situated in a

position different from the combined center of gravity of the holding portion and the medical instrument and the supporting mechanism further includes a support arm having a first end and a second end, the first end being supported on the moving mechanism;

the moving mechanism has a parallelogrammatic link mechanism, the link mechanism including: a first arm having first and second arm ends, the first arm end being connected to the support arm; a second arm having third and fourth arm ends, the third arm end being rotatably connected to the first arm end of the first arm, the second arm being coupled to the shaft portion between the third and fourth arm ends of the second arm to support the moving mechanism for rotating motion; a third arm kept parallel to the second arm and having fifth and sixth arm ends, the sixth arm end being connected to the second arm end of the first arm; and a fourth arm having seventh and eighth arm ends, the seventh arm end being connected to the fourth arm end of the second arm and the eighth arm end being connected to the fifth arm end of the third arm so as to be parallel to the first arm, the counterweight being located on the eighth arm end of the fourth arm;

the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis of the fourth arm; and

the ball joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving mechanism, and the adjusting mechanism includes an arithmetic mechanism which calculates the variation of the rotation moment around the shaft portion, based on the angle of inclination of the holding portion detected by means of the detecting mechanism, and a barycenter position adjusting mechanism which moves the counterweight along the axis of the fourth arm, thereby adjusting the position of the

center of gravity of the counterweight, in accordance with the result of computation by the arithmetic mechanism.

10-12. (Canceled)

13. (Previously Presented) A medical instrument holding apparatus comprising:

a supporting mechanism which has a distal end portion supporting a medical instrument and a holding portion being held by the operator;

a moving mechanism which has first and second sides and which supports the supporting mechanism;

a shaft portion located between the first and second sides and allowing the medical instrument and the supporting mechanism to be rotated about the shaft portion;

a basal portion which is coupled to the shaft portion, the basal portion supporting the moving mechanism and allowing the moving mechanism to rotate about the shaft portion;

a ball joint located between the moving mechanism and the supporting mechanism to operatively connect the moving mechanism and the supporting mechanism, the ball joint being provided in a position shifted from a center of gravity of the holding portion on the supporting mechanism toward the moving mechanism, the ball joint further supporting the supporting mechanism to be pivotable with respect to the moving mechanism; and

a counterweight which is located on the second side of the moving mechanism such that a first rotation moment is smaller than a second rotation moment generated from the weights of the medical instrument and the supporting mechanism, the counterweight acting about the shaft portion in the opposite direction to the second rotation moment;

wherein:

the moving mechanism and the supporting mechanism have braking mechanisms capable of being switched between a restrictive state in which the moving and supporting mechanisms are prevented from moving and a permissive state in which the mechanisms are allowed to move, and the supporting mechanism has a switch which is operated by an operator and switches the braking mechanisms to switch the moving and supporting mechanisms between the restrictive state and the permissive state;

the moving mechanism has a parallelogrammatic link mechanism, the link mechanism including: a first arm having first and second arm ends, the first arm being supported on the supporting mechanism; a second arm having third and fourth arm ends, the third arm end being rotatably connected to the first arm end of the first arm, the second arm being coupled to the shaft portion between the third and fourth arm ends of the second arm to support the moving mechanism for rotating motion; a third arm kept parallel to the second arm and having fifth and sixth arm ends, the sixth arm end being connected to the second arm end of the first arm; and a fourth arm having seventh and eighth arm ends, the seventh arm end being connected to the fourth arm end of the second arm and the eighth arm end being connected to the third arm so as to be parallel to the first arm, the fourth arm having the counterweight on the eighth arm end thereof;

the first arm is shorter than the fourth and second arms;

the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis of the fourth arm; and

the ball joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving mechanism, and the adjusting mechanism

includes an arithmetic mechanism which calculates the variation of the rotation moment around the shaft portion, based on the angle of inclination of the holding portion detected by means of the detecting mechanism, and a barycenter position adjusting mechanism which moves the counterweight along the axis of the fourth arm, thereby adjusting the position of the center of gravity of the counterweight, in accordance with the result of computation by the arithmetic mechanism.

14. (Canceled)

15. (Previously Presented) A medical instrument holding apparatus comprising:

a supporting mechanism which has a distal end portion supporting a medical instrument and a holding portion being held by the operator;

a moving mechanism which has first and second sides and which supports the supporting mechanism;

a shaft portion located between the first and second sides and allowing the medical instrument and the supporting mechanism to be rotated about the shaft portion;

a basal portion which is coupled to the shaft portion, the basal portion supporting the moving mechanism and allowing the moving mechanism to rotate about the shaft portion;

a ball joint located between the moving mechanism and the supporting mechanism to operatively connect the moving mechanism and the supporting mechanism, the ball joint being provided in a position shifted from a center of gravity of the holding portion on the supporting mechanism toward the moving mechanism, the ball joint further supporting the supporting mechanism to be pivotable with respect to the moving mechanism; and

a counterweight which is located on the second side of the moving mechanism such that a first rotation moment is smaller than a second rotation moment generated from the weights of the medical instrument and the supporting mechanism, the counterweight acting about the shaft portion in the opposite direction to the second rotation moment;

wherein:

the moving mechanism and the supporting mechanism have braking mechanisms capable of being switched between a restrictive state in which the moving and supporting mechanisms are prevented from moving and a permissive state in which the mechanisms are allowed to move, and the supporting mechanism has a switch which is operated by an operator and switches the braking mechanisms to switch the moving and supporting mechanisms between the restrictive state and the permissive state;

the moving mechanism has a parallelogrammatic link mechanism, the link mechanism including: a first arm having first and second arm ends, the first arm being supported on the supporting mechanism; a second arm having third and fourth arm ends, the third arm end being rotatably connected to the first arm end of the first arm, the second arm being coupled to the shaft portion between the third and fourth arm ends of the second arm to support the moving mechanism for rotating motion; a third arm kept parallel to the second arm and having fifth and sixth arm ends, the sixth arm end being connected to the second arm end of the first arm; and a fourth arm having seventh and eighth arm ends, the seventh arm end being connected to the fourth arm end of the second arm and the eighth arm end being connected to the third arm so as to be parallel to the first arm, the fourth arm having the counterweight on the eighth arm end thereof;

the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis of the fourth arm; and

the ball joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving mechanism, and the adjusting mechanism includes an arithmetic mechanism which calculates the variation of the rotation moment around the shaft portion, based on the angle of inclination of the holding portion detected by means of the detecting mechanism, and a barycenter position adjusting mechanism which moves the counterweight along the axis of the fourth arm, thereby adjusting the position of the center of gravity of the counterweight, in accordance with the result of computation by the arithmetic mechanism.

16-19. (Canceled)

20. (Previously Presented) A medical instrument holding apparatus comprising:

a medical instrument;

a supporting mechanism which has a distal end portion supporting the medical instrument and a holding portion being held by the operator;

a moving mechanism which has first and second sides and which supports the supporting mechanism;

a shaft portion located between the first and second sides and allowing the medical instrument and the supporting mechanism to be rotated about the shaft portion;

a basal portion which is coupled to the shaft portion, the basal portion supporting the moving mechanism and allowing the moving mechanism to rotate about the shaft portion;

a ball joint located between the moving mechanism and the supporting mechanism to operatively connect the moving mechanism and the supporting mechanism, the ball joint being provided in a position shifted from a center of gravity of the holding portion on the supporting mechanism toward the moving mechanism, the ball joint further supporting the supporting mechanism to be pivotable with respect to the moving mechanism; and

a counterweight which is located on the second side of the moving mechanism such that a first rotation moment is smaller than a second rotation moment generated from the weights of the medical instrument and the supporting mechanism, the counterweight acting about the shaft portion in the opposite direction to the second rotation moment;

wherein:

the holding portion is located so that a combined center of gravity of the holding portion and the medical instrument and the center of operation by the operator are situated in different positions; a center of inclination of the ball joint around which the holding portion is inclined by means of the ball joint being situated in a position different from the center of gravity of a heavy structure including the holding portion and the medical instrument and the supporting mechanism further includes a support arm having a first end and a second end, the first end being supported on the moving mechanism and the second end supporting the ball joint;

the moving mechanism has a parallelogrammatic link mechanism, the link mechanism including: a first arm having first and second arm ends, the first arm end being connected to the support arm; a second arm having third and fourth arm ends, the third arm end being rotatably connected to the first arm end of the first arm, the second arm being coupled to the shaft portion between the third and fourth arm ends of the second arm to

support the moving mechanism for rotating motion; a third arm kept parallel to the second arm and having fifth and sixth arm ends, the sixth arm end being connected to the second arm end of the first arm; and a fourth arm having seventh and eighth arm ends, the seventh arm end being connected to the fourth arm end of the second arm and the eighth arm end being connected to the fifth arm end of the third arm so as to be parallel to the first arm, the counterweight being located on the eighth arm end of the fourth arm;

the first arm is shorter than the fourth and second arms;

the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis of the fourth arm; and

the ball joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving mechanism, and the adjusting mechanism includes an arithmetic mechanism which calculates the variation of the rotation moment around the shaft portion, based on the angle of inclination of the holding portion detected by means of the detecting mechanism, and a barycenter position adjusting mechanism which moves the counterweight along the axis of the fourth arm, thereby adjusting the position of the center of gravity of the counterweight, in accordance with the result of computation by the arithmetic mechanism.

21. (Canceled)

22. (Previously Presented) A medical instrument holding apparatus comprising:

a medical instrument;

a supporting mechanism which has a distal end portion supporting the medical instrument and a holding portion being held by the operator;

a moving mechanism which has first and second sides and which supports the supporting mechanism;

a shaft portion located between the first and second sides and allowing the medical instrument and the supporting mechanism to be rotated about the shaft portion;

a basal portion which is coupled to the shaft portion, the basal portion supporting the moving mechanism and allowing the moving mechanism to rotate about the shaft portion;

a ball joint located between the moving mechanism and the supporting mechanism to operatively connect the moving mechanism and the supporting mechanism, the ball joint being provided in a position shifted from a center of gravity of the holding portion on the supporting mechanism toward the moving mechanism, the ball joint further supporting the supporting mechanism to be pivotable with respect to the moving mechanism; and .

a counterweight which is located on the second side of the moving mechanism such that a first rotation moment is smaller than a second rotation moment generated from the weights of the medical instrument and the supporting mechanism, the counterweight acting about the shaft portion in the opposite direction to the second rotation moment;

wherein:

the holding portion is located so that a combined center of gravity of the holding portion and the medical instrument and the center of operation by the operator are situated in different positions; a center of inclination of the ball joint around which the holding portion is inclined by means of the ball joint being situated in a position different from the center of gravity of a heavy structure including the holding portion and the medical instrument and the supporting mechanism further includes a support arm having a first end and a second

end, the first end being supported on the moving mechanism and the second end supporting the ball joint;

the moving mechanism has a parallelogrammatic link mechanism, the link mechanism including: a first arm having first and second arm ends, the first arm end being connected to the support arm; a second arm having third and fourth arm ends, the third arm end being rotatably connected to the first arm end of the first arm, the second arm being coupled to the shaft portion between the third and fourth arm ends of the second arm to support the moving mechanism for rotating motion; a third arm kept parallel to the second arm and having fifth and sixth arm ends, the sixth arm end being connected to the second arm end of the first arm; and a fourth arm having seventh and eighth arm ends, the seventh arm end being connected to the fourth arm end of the second arm and the eighth arm end being connected to the fifth arm end of the third arm so as to be parallel to the first arm, the counterweight being located on the eighth arm end of the fourth arm;

the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis of the fourth arm; and

the ball joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving mechanism, and the adjusting mechanism includes an arithmetic mechanism which calculates the variation of the rotation moment around the shaft portion, based on the angle of inclination of the holding portion detected by means of the detecting mechanism, and a barycenter position adjusting mechanism which moves the counterweight along the axis of the fourth arm, thereby adjusting the position of the center of gravity of the counterweight, in accordance with the result of computation by the arithmetic mechanism.

23-25. (Canceled)

26. (Previously Presented) A medical instrument holding apparatus comprising:

a supporting mechanism which has a distal end portion supporting a medical instrument and a holding portion being held by the operator;

a moving mechanism which has first and second sides and which supports the supporting mechanism;

a shaft portion located between the first and second sides and allowing the medical instrument and the supporting mechanism to be rotated about the shaft portion;

a basal portion which is coupled to the shaft portion, the basal portion supporting the moving mechanism and allowing the moving mechanism to rotate about the shaft portion;

a ball joint located between the moving mechanism and the supporting mechanism to operatively connect the moving mechanism and the supporting mechanism, the ball joint being provided in a position shifted from a center of gravity of the holding portion on the supporting mechanism toward the moving mechanism, the ball joint further supporting the supporting mechanism to be pivotable with respect to the moving mechanism; and

a counterweight which is located on the second side of the moving mechanism such that a first rotation moment is smaller than a second rotation moment generated from the weights of the medical instrument and the supporting mechanism, the counterweight acting about the shaft portion in the opposite direction to the second rotation moment;

wherein:

the moving mechanism has a parallelogrammatic link mechanism, the link mechanism including: a first arm having first and second arm ends, the first arm end being supported on the supporting mechanism; a second arm having third and fourth arm ends, the third arm end being rotatably connected to the first arm end of the first arm, the second arm being coupled to the shaft portion between the third and fourth arm ends of the second arm to support the moving mechanism for rotating motion, and coupled to the basal portion by means of the shaft portion; a third arm kept parallel to the second arm and having fifth and sixth arm ends, the sixth arm end being connected to the second arm end of the first arm; and a fourth arm having seventh and eighth arm ends, the seventh arm end being connected to the fourth arm end of the second arm and the eighth arm end being connected to the third arm so as to be parallel to the first arm, the fourth arm having the counterweight on the eighth arm end thereof;

the first arm is shorter than the fourth and second arms;

the counterweight has an adjusting mechanism which adjusts the position of the center of gravity of the counterweight along the axis of the fourth arm; and

the ball joint includes a detecting mechanism which detects the angle of inclination of the holding portion to the moving mechanism, and the adjusting mechanism includes an arithmetic mechanism which calculates the variation of the rotation moment around the shaft portion, based on the angle of inclination of the holding portion detected by means of the detecting mechanism, and a barycenter position adjusting mechanism which moves the counterweight along the axis of the fourth arm, thereby adjusting the position of the center of gravity of the counterweight, in accordance with the result of computation by the arithmetic mechanism.

27-35. (Canceled)